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| EXAMINER |
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LANDAU, MATTHEW C

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| ART UNIT | PAPER NUMBER |
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2815

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03/03/2008

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

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|------------------------------|--------------------------------------|-----------------------------------|--|
| Office Action Summary | Application No. 09/559,903 | Applicant(s) YIN ET AL. | |
| | Examiner Matthew C. Landau | Art Unit 2815 | |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 20 December 2007.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 27,33,36-38 and 44-52 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 27,33,36-38 and 44-52 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 27, 33, 36-38, and 44-52 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kumar et al. (US Pat. 6,541,164, hereinafter Kumar) in view of Applicant's admitted prior art (hereinafter APA), or in the alternative, as being unpatentable over Kumar in view of the APA and Chen et al. (US Pat. 4,905,073, hereinafter Chen).

Regarding claims 27 and 44, Figures 2, 11, 14, and 17 of Kumar disclose a gate stack, comprising: a gate oxide layer 14 over a semiconductor substrate 12; a polysilicon layer 16a on the gate oxide layer; a metal silicide layer 22 on the polysilicon layer; an antireflection layer 18 comprising $\text{Si}_x\text{N}_y\text{O}_z\text{:H}$ (col. 9, lines 1-7) formed over and in physical contact with the metal silicide layer; and a silicon nitride layer 23 (col. 9, lines 35-37) on the layer comprising $\text{Si}_x\text{N}_y\text{O}_z\text{:H}$, wherein the polysilicon layer, the gate oxide layer, the metal silicide layer, the layer comprising $\text{Si}_x\text{N}_y\text{O}_z\text{:H}$, and the silicon nitride layer are patterned to form the gate stack. Kumar does not disclose the specific composition claimed. Figure 3 of the instant application discloses an antireflective layer 26 made of $\text{Si}_x\text{N}_y\text{O}_z\text{:H}$, wherein x is from 0.39 to 0.65, y is from 0.02 to 0.56, and z is from 0.05 to 0.33 (see page 3, lines 13-15 of the instant specification). In view of such teaching, it would have been obvious to the ordinary artisan at the time the invention was made to modify the invention of Kumar by using the antireflective layer composition as taught

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by the APA for the purpose of selecting a material known to be used for the same purpose. The selection of a known material based on its suitability for its intended use supported a prima facie obviousness determination in *Sinclair & Carroll Co. v. Interchemical Corp.*, 325 U.S. 327, 65 USPQ 297 (1945) (see MPEP 2144.07). As indicated above, both the composition of Kumar and the composition of the APA are known, and they are known to be used for antireflective layers. The ordinary artisan would have been able to substitute the composition of Kumar with that disclosed by the APA without undue experimentation, and the results of that substitution would have been predictable. Therefore, it would have been obvious to one of ordinary skill in the art to substitute one composition for the other to achieve the predictable result of obtaining an antireflective film. *KSR International Co. v. Teleflex Inc.*, 82 USPQ2d 1385 (2007).

Furthermore, since composition of Kumar contains all the same elements as the claimed composition (Si, N, O, and H), the difference between Kumar and the claimed invention is simply it the specific claimed values for variable x, y, and z (i.e., the specific amounts of each compositional element). However, it would have been obvious to adjust the amounts of the various different elements in the antireflective layer of Kumar to arrive at the specified claimed composition, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980). It is known that the composition of an antireflection layer affects the optical properties, therefore the claimed variables are result effective variables.

The limitations “annealed metal silicide layer” and “the annealed metal silicide layer being the product of a process in which the metal silicide layer is subjected to an anneal treatment after the layer comprising $\text{Si}_x\text{N}_y\text{O}_z\text{:H}$ is formed” are merely product-by-process

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limitations that do not structurally distinguish the claimed invention over the prior art. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process. *In re Thorpe*, 227 USPQ 964, 966. The burden is on Applicant to show that the process necessarily results in structurally different product from that disclosed in the prior art.

Assuming, *arguendo*, that Applicant can prove that annealing a metal silicide layer inherently results in structurally different product; the claim would still be held obvious in view of Chen. Chen discloses annealing a metal silicide layer in a nitrogen atmosphere (col. 3, lines 49-51). In view of such teaching, it would have been obvious to the ordinary artisan at the time the invention was made to modify the invention of Kumar by annealing the metal silicide layer for the purpose of improving the resistivity (see col. 3, lines 49-51 of Chen).

Note that the limitations “the layer comprising $\text{Si}_x\text{N}_y\text{O}_z\text{:H}$ protects the annealed metal silicide layer during the anneal by eliminating exposure to gaseous oxygen during the anneal” (claim 27), the limitation “means for protecting the metal silicide layer during an anneal” (claim 44), the limitation “the layer comprising $\text{Si}_x\text{N}_y\text{O}_z\text{:H}$ is configured to reduce a stress on the gate stack that is imposed by the silicon nitride layer” (claim 27), and the limitation “the $\text{Si}_x\text{N}_y\text{O}_z\text{:H}$ layer reduces a stress on the gate stack” are merely functional/intended use limitations that do not structurally distinguish the claimed invention over the prior art. While features of an apparatus may be recited either structurally or functionally, claims directed to an apparatus must be distinguished from the prior art in terms of structure rather than function. *In re Schreiber*, 128 F.3d 1473, 1477-78, 44 USPQ2d 1429, 1431-32 (Fed. Cir. 1997). After the above combination,

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the $\text{Si}_x\text{N}_y\text{O}_z\text{:H}$ layer is inherently capable of performing the recited function. Therefore, the claim limitation is met.

Regarding claims 33 and 47, Kumar discloses the layer 18 comprising $\text{Si}_x\text{N}_y\text{O}_z\text{:H}$ has a thickness of 300 angstroms (col. 30, lines 58-61).

Regarding claims 36, 37, 45, and 51, Kumar and the APA do not disclose the specific claimed values for variable x, y, and z (specifically, $x=0.5$, $y=0.37$, and $z=0.13$). However, it would have been obvious to one having ordinary skill in the art at the time the invention was made to further modify Kumar by using the claimed values, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980). It is known that the composition of an antireflection layer affects the optical properties, therefore the claimed variables are result effective variables.

Regarding claims 38 and 46, Kumar discloses the metal silicide is tungsten silicide (col. 8, lines 17 and 18) and therefore does not comprise titanium. However, Chen discloses tungsten silicide and titanium silicide can be equivalently used for the same purpose. In view of such teaching, it would have been obvious to the ordinary artisan at the time the invention was made to modify the invention of Kumar by using titanium silicide for the purpose of substituting an equivalent material that is known to be used for the same purpose (see MPEP 2144.06).

Regarding claim 48, the limitation “the means for protecting the metal silicide layer during is adapted to protect the metal silicide layer from gaseous oxygen during the anneal” is merely a recitation of intended use that does not structurally distinguish the claimed invention over the prior art. If the prior art structure is capable of performing the intended use, then it

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meets the claim. After the above combination, the $\text{Si}_x\text{N}_y\text{O}_z\text{:H}$ layer is inherently capable of performing the recited function. Therefore, the claim limitation is met.

Regarding claim 49, the limitation “the means for protecting the metal silicide layer during is adapted to alleviate stress exerted by the silicon nitride layer on layers underlying the layer comprising $\text{Si}_x\text{N}_y\text{O}_z\text{:H}$ ” is merely a recitation of intended use that does not structurally distinguish the claimed invention over the prior art. If the prior art structure is capable of performing the intended use, then it meets the claim. The $\text{Si}_x\text{N}_y\text{O}_z\text{:H}$ layer 18 of Kumar is capable of performing the recited function, therefore the limitation is met.

Regarding claims 50, Figures 2, 11, 14, and 17 of Kumar disclose a gate stack, comprising: a gate oxide layer 14 over a semiconductor substrate 12; a polysilicon layer 16a on the gate oxide layer; a metal silicide layer 22 on the polysilicon layer; an antireflection layer 18 comprising $\text{Si}_x\text{N}_y\text{O}_z\text{:H}$ (col. 9, lines 1-7) formed over and in physical contact with the metal silicide layer; and a silicon nitride layer 23 (col. 9, lines 35-37) on the layer comprising $\text{Si}_x\text{N}_y\text{O}_z\text{:H}$, wherein the polysilicon layer, the gate oxide layer, the metal silicide layer, the layer comprising $\text{Si}_x\text{N}_y\text{O}_z\text{:H}$, and the silicon nitride layer are patterned to form the gate stack. Kumar does not disclose the specific claimed values for variable x, y, and z, and therefore does not disclose the specific composition claimed. Figure 3 of the instant application discloses an antireflective layer 26 made of $\text{Si}_x\text{N}_y\text{O}_z\text{:H}$, wherein x is from 0.39 to 0.65, y is from 0.02 to 0.56, and z is from 0.05 to 0.33 (see page 3, lines 13-15 of the instant specification). In view of such teaching, it would have been obvious to the ordinary artisan at the time the invention was made to modify the invention of Kumar by using an antireflective layer having a composition as taught by the APA for the purpose of selecting a material known to be used for the same purpose. The

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selection of a known material based on its suitability for its intended use supported a prima facie obviousness determination in *Sinclair & Carroll Co. v. Interchemical Corp.*, 325 U.S. 327, 65 USPQ 297 (1945) (see MPEP 2144.07). As indicated above, both the composition of Kumar and the composition of the APA are known, and they are known to be used for antireflective layers. The ordinary artisan would have been able to substitute the composition of Kumar with that disclosed by the APA without undue experimentation, and the results of that substitution would have been predictable. Therefore, it would have been obvious to one of ordinary skill in the art to substitute one composition for the other to achieve the predictable result of obtaining an antireflective film. *KSR International Co. v. Teleflex Inc.*, 82 USPQ2d 1385 (2007).

Furthermore, since composition of Kumar contains all the same elements as the claimed composition (Si, N, O, and H), the difference between Kumar and the claimed invention is simply it the specific claimed values for variable x, y, and z (i.e., the specific amounts of each compositional element). However, it would have been obvious to adjust the amounts of the various different elements in the antireflective layer of Kumar to arrive at the specified claimed composition, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980). It is known that the composition of an antireflection layer affects the optical properties, therefore the claimed variables are result effective variables.

Kumar discloses the metal silicide is tungsten silicide (col. 8, lines 17 and 18), not titanium silicide. However, Chen discloses tungsten silicide and titanium silicide can be equivalently used for the same purpose. In view of such teaching, it would have been obvious to the ordinary artisan at the time the invention was made to modify the invention of Kumar by

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using titanium silicide for the purpose of substituting an equivalent material that is known to be used for the same purpose (see MPEP 2144.06). The limitation “annealed” is merely a product-by-process limitation that does not structurally distinguish the claimed invention over the prior art. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process. *In re Thorpe*, 227 USPQ 964, 966. The burden is on Applicant to show that the process necessarily results in structurally different product from that disclosed in the prior art.

Assuming, *arguendo*, that Applicant can prove that annealing a metal silicide layer inherently results in structurally different product; the claim would still be held obvious in view of Chen. Chen discloses annealing a metal silicide layer in a nitrogen atmosphere (col. 3, lines 49-51). In view of such teaching, it would have been obvious to the ordinary artisan at the time the invention was made to modify the invention of Kumar by annealing the metal silicide layer for the purpose of improving the resistivity (see col. 3, lines 49-51 of Chen).

The limitation “for alleviating stress on underlying layers, canceling reflected radiation, and protecting the annealed, titanium silicide layer during an anneal from gaseous oxygen” is merely a functional/intended use limitation that does not structurally distinguish the claimed invention over the prior art. While features of an apparatus may be recited either structurally or functionally, claims directed to an apparatus must be distinguished from the prior art in terms of structure rather than function. *In re Schreiber*, 128 F.3d 1473, 1477-78, 44 USPQ2d 1429, 1431-32 (Fed. Cir. 1997). After the above combination, the $\text{Si}_x\text{N}_y\text{O}_z\text{:H}$ layer is inherently capable of performing the recited functions. Therefore the claim limitation is met.

Regarding claim 52, Kumar discloses the layer 18 comprising $\text{Si}_x\text{N}_y\text{O}_z\text{:H}$ has a thickness of 300 angstroms (col. 30, lines 58-61).

Response to Arguments

Applicant's arguments filed December 20, 2007 have been fully considered but they are not persuasive.

Applicant argues that "the cited references (e.g., the Kumar reference, and the Chen reference) fail to disclose, or to fairly suggest that the disclosed antireflection layer is functionally operable to reducing a stress imposed on a gate stack. Specifically, it is asserted that the disclosed antireflection layer is operable to reduce a stress that may be imposed by an adjacent silicon nitride layer". While features of an apparatus may be recited either structurally or functionally, claims directed to an apparatus must be distinguished from the prior art in terms of structure rather than function. *In re Schreiber*, 128 F.3d 1473, 1477-78, 44 USPQ2d 1429, 1431-32 (Fed. Cir. 1997). As stated in the above rejection, the proposed combination results in the same structure as claimed by Applicant. Specifically, after the above combination, the $\text{Si}_x\text{N}_y\text{O}_z\text{:H}$ layer has the same composition as the claimed layer and therefore is inherently capable of performing the recited function. Where the claimed and prior art products are identical or substantially identical in structure or composition, or are produced by identical or substantially identical processes, a prima facie case of either anticipation or obviousness has been established. *In re Best*, 562 F.2d 1252, 1255, 195 USPQ 430, 433 (CCPA 1977). The burden is on Applicant to prove, by way of factual evidence, that the product of proposed combination is not capable of

performing the recited. Simply arguing that the prior art structure does not explicitly disclose or suggest the recited function is not sufficient.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew C. Landau whose telephone number is 571-272-1731. The examiner can normally be reached on 9:00AM - 5:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ken Parker can be reached on 571-272-2298. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Matthew C. Landau/
Primary Examiner, Art Unit 2815